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Indian Standard

RECOMMENDED CONSTRUCTION PRACTICE OF APPARATUS FOR SPRAY CABINET FOR VARIOUS SALT SPRAY TESTS

UDC 620·193·272·05·002·2

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 3

July 1987

Indian Standard

RECOMMENDED CONSTRUCTION PRACTICE OF APPARATUS FOR SPRAY CABINET FOR VARIOUS SALT SPRAY TESTS

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(*Continued on page* 2)

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Indian Standard

RECOMMENDED CONSTRUCTION PRACTICE OF APPARATUS FOR SPRAY CABINET FOR VARIOUS SALT SPRAY TESTS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 25 August 1986, after the draft finalized by the Metallic and Non-Metallic Finishes Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 The requirements regarding corrosion resistance test, exposure duration and evaluation of corrosion of electroplated coatings have been specified in the relevant Indian Standards on electroplating. In this standard, the construction details of apparatus have been prescribed, wherein a common recommendation for apparatus may satisfy the requirements of different salt spray tests stipulated in IS : 5528-1985*, IS : 6910-1985† and IS : 9844-1981‡ for corrosion resistance of electroplated components and anodized aluminium coatings.

0.3 The reliability, reproducibility and accuracy of the salt spray corrosion tests depends on proper and consistent control of a number of factors, including:

a) cleaning of test specimens,

b) positioning of specimens and samples in spray cabinet,

c) rate of condensation of salt spray within the spray cabinet,

d) maintenance of spray cabinet, and

e) temperature control in spray cabinet.

0.4 While preparing this standard, necessary assistance has been derived from the following:

---

*Method of testing corrosion resistance of electroplated and anodized aluminium coating by copper accelerated acetic acid salt spray (CASS) test (*first revision*).

†Method of testing corrosion resistance of electroplated and anodized aluminium coatings by acetic acid salt spray test (*first revision*).

‡Methods of testing corrosion resistance of electroplated and anodized aluminium coatings by neutral salt spray test.

ISO 3769-1976 (E) Metallic coatings – Copper accelerated acetic acid salt spray test (CASS TEST). International Organization for Standardization.

ANSI/ASTM B 117-73 (Reapproved 1979) — Standard method of salt spray (FOG) testing. American Society for Testing and Materials.

Euronorm 175 — Salt spray test on flat steel products with metal. British Standards Institution.

1. SCOPE

1.1 This standard recommends the construction of apparatus required for salt spray tests prescribed in IS : 5528-1985*, IS : 6910-1985†, and IS : 9844-1981‡. This apparatus may be used for corrosion testing of decorative coatings of copper plus nickel plus chromium or nickel plus chromimum and anodic coatings on aluminium.

1.2 This standard does not specify the type of test specimen, the exposure period to be used for a particular product and the interpretation of results. Such details are provided in the appropriate coating/method of test specifications.

2. TEST APPARATUS REQUIREMENTS

2.1 The apparatus consists essentially of a fog chamber (test cabinet) with compressed air inlet, a solution reservoir, a solution atomizing device, specimen supports and temperature control equipment.

2.1.1 The method of construction shall be such that they shall not get corroded by the fog/spray in the chamber. In general, all component of the apparatus that come in contact with spray or test solution shall be of materials resistant to the corrosive solution.

2.2 Test Cabinet — The dimensions, shape and construction of this cabinet are not strictly laid down but it shall meet the following requirements:

a) The capacity shall be at least 0·43 m^3 since smaller volumes may create difficulties for ensuring even distribution of the spray.

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*Method of testing corrosion resistance of electroplated and anodized aluminium coating by copper accelerated acetic acid salt spray (CASS) test (*first revision*).

†Method of testing corrosion resistance of electroplated and anodized aluminium coatings by acetic acid salt spray test (*first revision*).

‡Methods of testing corrosion resistance of electroplated and anodized aluminium coatings by neutral salt spray test.

b) Accessories, such as suitable adjustable baffle or central fog tower, automatic level control for salt reservoir and automatic level control for air saturator tower are pertinent parts of the apparatus.

c) The chamber may be made of inert materials such as plastic, glass or stone or any suitable corrosion resistant material.

d) The test cabinet shall be shaped suitably such that drops of sprayed solution do not fall from ceiling, the side walls and the baffles into the test pieces. This can, for example, be achieved, if the ceiling is inclined by at least 30 degree to the horizontal.

2.3 Means of Supplying and Controlling Heat

2.3.1 Suitable measuring and control equipment must be available to supply and control the prescribed test temperature. An even temperature distribution shall be achieved by adequate thermal insulation of the test cabinet.

2.3.2 The temperature shall be controlled by thermostat placed either within the test cabinet at a distance of at least 100 mm from the walls or in a water jacket around the cabinet. In either case, a thermometer, capable of being read from the outside shall be placed within the test cabinet at a distance of at least 100 mm from the walls.

2.4 Spray Apparatus

2.4.1 Spray apparatus consists of a supply of clean air of controlled pressure and humidity, a reservoir to contain the test solution and one or more atomizers. The compressed air supplied for atomizing the solution shall be free from contaminants such as oil and dirt. In order to prevent evaporation of water from the sprayed solution, the air shall be saturated with water before entering the atomizer; to this end, it is passed through air humidifier which contains water, the properties of which satisfy the requirements of test solution and the temperature of which is higher than the temperature in the test cabinet. The appropriate temperature depends on the pressure used and the type of atomizer nozzle. The temprature shall be capable of regulation and shall be adjusted such that the quantity and concentration of the salt solution collected in the test cabinet corresponds to what is prescribed in the test.

2.4.2 The atomizer shall be made of inert materials, for example, plastic. It should be noted that the spray must not be aimed directly into the test pieces. To achieve this, it will be useful to direct the spray against a baffle or directing plate in such a way that a uniform distribution of the spray through the entire test cabinet is obtained.

2.4.3 An illustration and details of a typical cabinet are given in Appendix A.

2.5 Collecting Device

2.5.1 At least two collecting devices (or even 4 numbers) are being used. They shall be in the form of glass funnels of approximately 10 cm diameter (that is, with a horizontal collecting area of approximately 80 cm^2) fixed to a graduated measuring glass cylinder of 50 ml capacity.

2.5.2 The collecting devices shall be placed in the zone of the cabinet where the test specimens are placed, one close to an inlet of spray and one remote from an inlet. They shall be so placed that only spray and not liquid falling from specimens or from part of the cabinet is collected.

2.5.3 If the test equipment has been used for one type of spray test, the equipment should be thoroughly cleaned prior to conducting the other type of spray test.

2.6 Provision for Exposure of Test Specimens

2.6.1 Suitable provision should be made for placing one or two rods in the chamber at a convenient height for the suspension of test specimens by means of synthetic fibre.

3. RECOMMENDATIONS FOR CONSTRUCTION OF THE APPARATUS

3.1 Chamber — The chamber may be constructed with a double wall system with suitable insulating material or any other suitable practice. Interior lining may be of polypropylene sheets of sufficient thickness. The top lid is fixed to the chamber; a hydraulic seal may be provided to avoid escape of fog into the atmosphere of the room. An exhaust line may be provided for the escape of fog, if found necessary.

3.2 The entire unit may be on castor wheels for portability.

3.3 Compressed air at adjustable pressure may be heated up in a preheating chamber, passed through a hot water tower which shall have a level control device. Air and water solenoid system may be provided for effective controls. Level of salt solution in the tray inside the chamber shall be controlled with the aid of a plastic float valve. Similarly, provision of a float valve in the water tank helps water flow into the air humidifier tower.

3.4 A drain hole may be provided at the bottom of the chamber to drain away the condensed salt solution.

3.5 All piping which comes in contact with the salt solution or spray shall be of inert materials such as plastic. Water used in the entire process shall be pure — for example, deionised water.

3.6 Capacities of water tank and salt solution reservoir shall be such as to permit a continuous operation for the duration required, day and night, when the persons conducting the test are not there.

4. MAINTENANCE

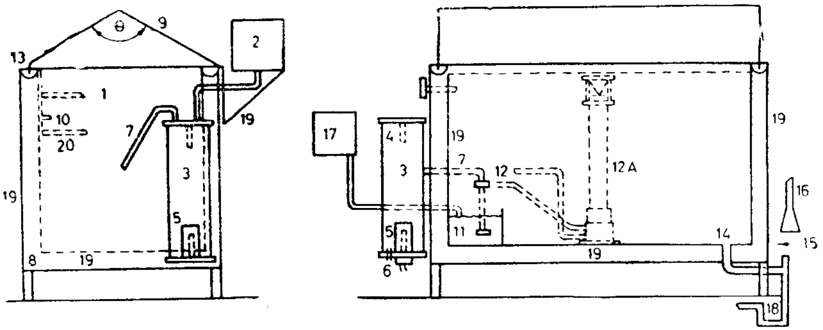
4.1 Periodical maintenance of the unit is important for a trouble-free performance.

4.2 The correct functioning of the unit may be judged by the rate of condensation of spray (1 to 2 ml per hour) and the concentration of condensate shall be as per the prescribed specification.

APPENDIX A

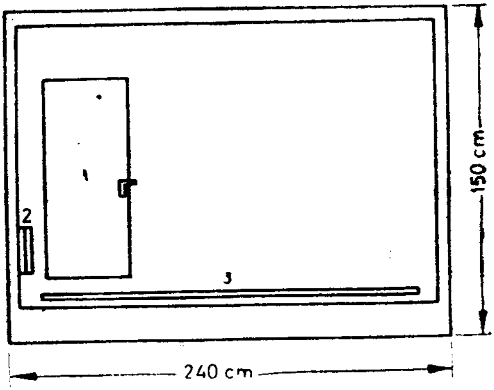
(*Clause* 2.4.3)

ILLUSTRATION AND DETAILS OF A TYPICAL SALT SPRAY CABINET



θ Angle of Lid, 90 to 125°
1 Thermometer and thermostat for controlling heater (Item 8) in base
2 Automatic water levelling device
3 Humidifying tower
4 Automatic temperature regulator for controlling heater (Item 5)
5 Immersion heater, non-rusting
6 Air inlet, multiple openings
7 Air tube to spray nozzle
8 Strip heater in base
9 Hinged top, hydraulically operated, or counter balanced
10 Brackets for rods supporting specimens, or test table
11 Internal reservoir
12 Spray nozzle above reservoir, suitably designed, located, and baffled
12A Spray nozzle housed in dispersion tower located preferably in centre of cabinet
13 Water seal
14 Combination drain and exhaust. Exhaust at opposite side of test space from spray nozzle (Item 12), but preferably in combination with drain, waste trap, and forced draft waste pipe (Items 15, 16 and 18)
15 Complete separation between forced draft waste pipe (Item 16) and combination drain and exhaust (Items 14 and 18) to avoid undesirable suction or back pressure
16 Forced draft waste pipe
17 Automatic levelling device for reservoir
18 Waste trap
19 Air space or water jacket
20 Test table or rack, well below roof area

FIG. 1 TYPICAL SALT SPRAY CABINET



NOTE — The controls are the same in general as for the laboratory cabinet (Fig. 2), but are sized to care for the larger cube. The chamber has the following features:

a) Heavy insulation;
b) Refrigeration door with drip rail, or pressure door with drip rail, inward sloping sill; and
c) Low temperature auxiliary heater.

FIG. 2 WALK-IN CHAMBER

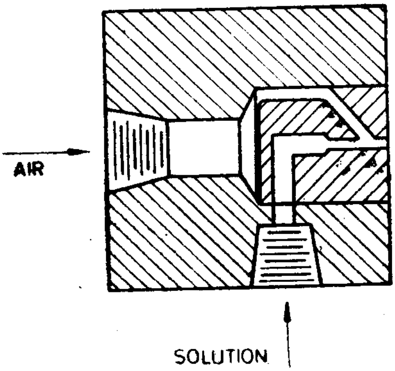


FIG. 3 TYPICAL SPRAY NOZZLE

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 $kg.m/s^2$
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2